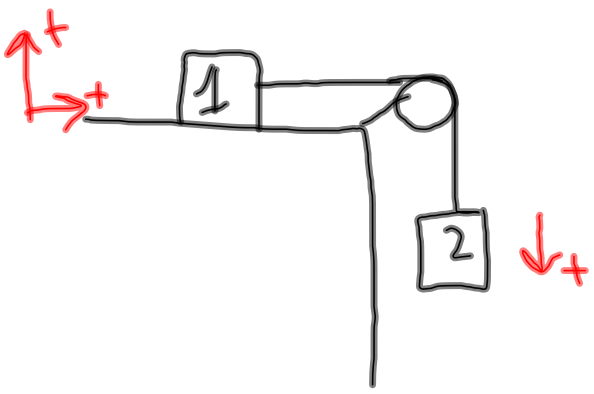
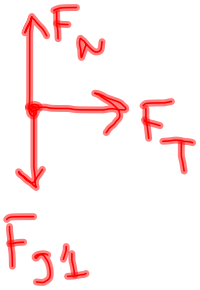
Force Practice Problems 4th Block 9.26.11

A 467 N block on a table is attached, via a rope and pulley, to another block of mass 34.7 kg that hangs off the table. If we ignore friction, what would the acceleration of the blocks be?



FBD 1:



FBD 2:

$\sum \bar{F}_{x1} = m_1 \bar{a}$

$F_T = m_1 a$

$\sum \bar{F}_{y2} = m_2 \bar{a}$

$F_{g2} - F_T = m_2 a$

$m_2 a_g - m_2 a = F_T$

$m_2 a_g - m_2 a = m_1 a$

$m_2 a_g = m_1 a + m_2 a$

$m_2 a_g = (m_1 + m_2) a$

$a = \dfrac{m_2 a_g}{(m_1 + m_2)}$

$m = \dfrac{F_g}{a_g}$

$m_1 = 47.65\ kg$

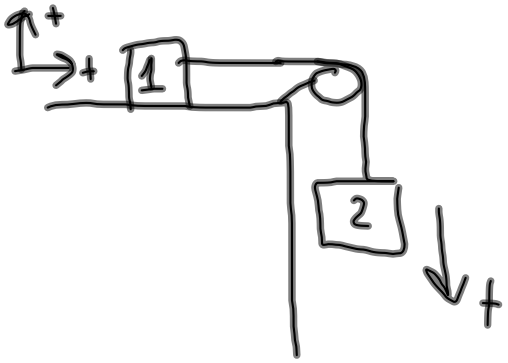
$m_2 = 34.7\ kg$

$a_g = 9.8\ m/s^2$

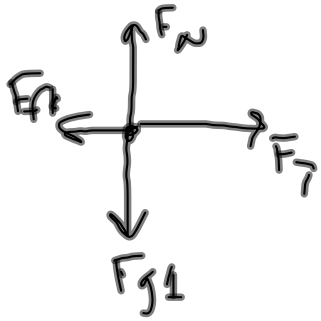
$= \dfrac{(34.7\ kg)(9.8\ m/s^2)}{(47.65\ kg + 34.7\ kg)}$

$= 4.12\ m/s^2$

A 467 N block on a table is attached, via a rope and pulley, to another block of mass 34.7 kg that hangs off the table. If the coefficient of friction is 0.134, what would the acceleration of the blocks be?



FBD 1:



FBD 2:

$$\sum \vec{F}_{y_2} = m_2 \vec{a}$$

$$F_{g2} - F_T = m_2 a$$

$$F_{g2} = m_2 a_g$$

$$m_2 a_g - m_1 a - \mu_k m_1 a_g = m_2 a$$

$$m_2 a_g - \mu_k m_1 a_g = m_1 a + m_2 a$$

$$a = \frac{a_g (m_2 - \mu_k m_1)}{(m_1 + m_2)}$$

$$= \frac{\left[(9.8\ m/s^2)(34.7\ kg - (.134)(47.7\ kg))\right]}{(47.7\ kg + 34.7\ kg)}$$

$$= 3.37\ m/s^2$$

$$\sum \vec{F}_{x_1} = m_1 \vec{a}$$

$$F_T - F_{fk} = m_1 a$$

$$F_T - \mu_k F_N = m_1 a$$

$$F_T - \mu_k m_1 a_g = m_1 a$$

$$\sum \vec{F}_{y_1} = 0$$

$$F_N - F_{g1} = 0$$

$$F_N = F_{g1} = m_1 a_g$$

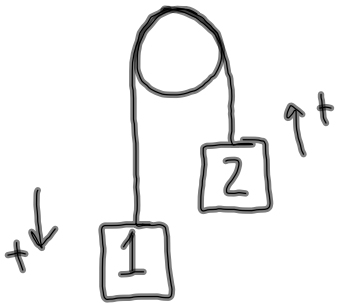
$$F_T = m_1 a + \mu_k m_1 a_g$$

A brick of gold hangs on a string. The brick has a mass of 5.00 kg.
a) How much tension is on the string?
b) If you then pull up on the string and make the brick accelerate upward at 2.55 m/s/s, how much tension will be on the string during the acceleration?
c) If instead you can only pull upward with a force of 13.5 N, what will it's acceleration be?

Two hanging blocks (block 1 mass = 8.0 kg; block 2 mass = 5.0 kg) are attached by a rope that is hung over a frictionless pulley.
a) Which way does each block accelerate?
b) What is the magnitude of the acceleration?

a) 1 → down

2 → up



FBD 1:

FBD 2:

$\sum F_{y1} = m_1 a$

$F_{g1} - F_T = m_1 a$

$F_{g1} = m_1 a_g$

$\sum F_{y2} = m_2 a$

$F_T - F_{g2} = m_2 a$ $\quad F_{g2} = m_2 a_g$

$F_T = m_2 a_g + m_2 a$

$m_1 a_g - (m_2 a_g + m_2 a) = m_1 a$

$m_1 a_g - m_2 a_g - m_2 a = m_1 a$

$m_1 a_g - m_2 a_g = m_1 a + m_2 a$

$$a = \frac{a_g(m_1 - m_2)}{(m_1 + m_2)}$$

$$= \frac{[(9.8\ m/s^2)(8.0\ kg - 5.0\ kg)]}{(8.0\ kg + 5.0\ kg)}$$

$$= 2.2\ m/s^2$$